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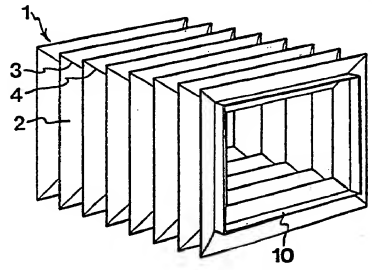

(57) Abstract

A protective bellows (1) for movable parts of a tool, such as a scissors-type lifting table, comprises at least three sheet-like bellows blanks (2), which are interconnected so as to form a tubutlar unit. The interconnected edges (3) of the blanks (2) have a saw-tooth shape. Each blank (2) has a first set of fold lines which, on one side of the blank (2), extend between opposite crests of the saw-tooth edges (3), as well as a second set of fold lines which, on the other side of the blank (2), extend between opposite troughs of the edges (3). The bellows (1) is made of a synthetic material, and the fold lines are provided by high-frequency welding. A method for making the protective bellows (1) is also disclosed.

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PROTECTIVE BELLOWS AND METHOD FOR MAKING THE SAME

The present invention relates to a protective bellows and a method for making the same. More specifically, the invention concerns a protective bellows for enclosing movable parts of a tool, such as a scissors-type lifting table, and a method for making such a bellows.

Protective bellows have long been used for widely different purposes. One important application concerns the enclosure of movable mechanical devices, such as the underframe of a scissors-type lifting table and piston and cylinder units in vehicles or workshop machinery, for protecting these devices from dirt and/or protecting the operator from injuries.

In general, prior-art protective bellows are composed of two or more layers of material, of which one has a stiffening function and the other or others serve to keep the bellows structure together so as to form the finished bellows. Alternatively, use is made of stiffening elements in the form of springs or steel rings arranged in the folds of the bellows. One instance of the prior art is disclosed in DE 12 51 650, which relates to a bellows composed of three layers of material. One layer has a stiffening function and comprises four sheets which are interconnected at the upper and lower edges by a narrow strip of material, whereby to form a coherent piece. Each sheet has slits extending across almost the entire sheet width. The slits constitute weakened portions where the material is folded when an inner and an outer layer of flexible material have been glued on to the stiffening layer.

The prior art suffers from several drawbacks. Using several layers of material is complicated, time-consuming as well as costly. Also, it involves a large consumption of material and many working operations. Since the sheets in the stiffening layer are only interconnected by two narrow strips, the finished bellows will have fairly weak

corners, these being formed of but the flexible and comparatively thin layers.

The object of the present invention is to obviate the above drawbacks in the manufacture of the protective bellows, as well as those associated with the finished bellows.

This object is achieved by a bellows and a method for making the same having the features recited in the characterising clauses of, respectively, appended claim 1 and appended claim 5.

One thus obtains a protective bellows which differs from prior-art bellows by being much simpler, self-supporting without any additional stiffening layers or stiffening elements, as well as time- and cost-effective in terms of production, owing to a reduced number of working operations and a substantially enhanced economy of material. A further advantage is that the bellows according to the invention has essentially the same strength all over.

The present invention will be described in more detail below with the aid of embodiments illustrated in the accompanying drawing, in which like reference numbers indicate like parts. In the drawings,

Fig. 1 is a schematic perspective view from above of a bellows according to the invention;

Fig. 2 is a schematic perspective view from below of the bellows in Fig. 1;

Fig. 3 is a schematic plan view of a blank forming part of the bellows in Fig. 1;

Fig. 4 is a schematic perspective view of the blank in Fig. 3 when folded together; and

Fig. 5 is a schematic perspective view of two interconnected blanks.

Fig. 1 shows a preferred embodiment of a bellows 1 according to the invention. This bellows is designed to enclose the underframe of a scissors-type lifting table, and is composed of four sheet-like blanks 2 interconnected along the edges 3 of their long sides. The resulting con-

necting portions 4 thus constitute the corners of the bellows 1. The blanks 2 consist of substantially rectangular fabrics of a synthetic material, preferably PVC. The edges 3 of the long sides of the blanks 2 have a saw-tooth shape, as shown in Fig. 5, which enables two blanks 2 that are interconnected along their long-side edges at an angle to fold. Further, the blanks 2 have a first set of fold lines 5, shown in Figs 3 and 5, extending between opposite crests 6 of the saw-tooth long-side edges 3, as well as a second set of fold lines 7 extending between opposite troughs 8 of the saw-tooth long-side edges 3. The first set of fold lines 5 is provided on the inside of the blank, i.e. on the side that forms the inside of the bellows, and the second set of fold lines 7 is provided on the outside of the blank. By the fold lines 5, 7, the blank 2 is divided into fold portions 9. Also, the fold lines 5, 7 make the material fold at precisely these lines and in a predetermined direction. Further, the fold lines impart stability to the material, resulting in pliable folding of the bellows 1. In the preferred embodiment, the fold lines 5, 7 are provided by means of a high-frequency welding machine, but also other tools and methods may, of course, be used. At the upper end, the bellows 1 is equipped with an upright circumferential flange 10 formed from an upper end portion 11 of each blank 2, the end portion 11 being twice as wide as a fold portion 9 and being folded into the shape of a T turned upside-down. The web of the end portion thus constitutes the flange, and the branches of the end portion are high-frequency welded to the fold portion 9 adjoining the end portion 11. This gives both the flange 10 and the fold portion 9 a double thickness of material, which is of importance, since the flange 10 is fixed to a corresponding flange of the scissors-type lifting table and thus carries the entire weight of the bellows 1.

As shown in Fig. 2, a circumferential channel 12 having openings 13 at each corner is provided at the lower end of the bellows 1. The channel 12 is formed of the two lowermost fold portions 9 of each blank 2 by high-frequency welding of the lower short-side edge 14 of the blank 2 to the lowermost but one fold portion 9. Flat irons, for instance, are introduced in the channel 12 which, with its contents, is fixed to the floor.

The preferred embodiment of the bellows 1 according to the invention is manufactured as follows.

Four rectangular equally-sized blanks 2 are cut from a roll of fabric of a high-frequency weldable synthetic material, preferably PVC. Each of the blanks 2 is provided with a first set of fold lines 5 on the inside, and a second set of fold lines 7 on the outside, as shown in Fig. 3. In doing this, every other fold line 5 is provided on the inside and every other fold line 7 is provided on the outside by high-frequency welding, a positive electrode being placed on the side of the blank 2 where the fold line 5, 7 is to be provided, and a negative electrode being placed on the other side of the blank 2. High-frequency voltage is generated between the electrodes, and the material in the blank is heated and deformed so as to form a fold line 5, 7. Then, the blank 2 is folded along the fold lines 5, 7, resulting in a body 15, i.e. a folded blank, as shown in Fig. 4. The body 15 is cut at both ends at an angle of 45° to the short sides, as illustrated by the dashed lines in Fig. 4, thereby forming a trapezium. The blank 2 is extended and now presents saw-tooth long-side edges 3, where the first set of fold lines 5 extend between opposite crests 6 of the saw-tooth long-side edges 3, and the second set of fold lines 7 extend between opposite troughs 8 of the saw-tooth long-side edges 3. All the blanks 2 are interconnected as shown in Fig. 5 so as to form a tubular unit, i.e. a bellows. The blanks then are arranged in pairs, applied against one another and interconnected by high-frequency welding along one long-side edge 3.

It goes without saying that various modifications of the inventive bellows and the inventive method are conceivable within the scope of the invention as defined in the appended claims. Thus, the fold lines may be provided by any optional method. Apart from PVC, polyurethane or some other suitable material may be used, depending, inter alia, on the interconnecting technique. The flange at the upper end of the bellows may be optionally positioned on the uppermost fold portion, e.g. at the outer or the inner periphery. Both the flange and the channel may be provided at one or both ends of each blank. Further, the blanks may have optional shape, such as triangular, ellipsoidal or irregular. The term "saw-tooth" relates not only to the symmetrical shape in the illustrated embodiment, but also to any regular or irregular shape presenting crests and troughs.

CLAIMS

1. A protective bellows (1) for movable parts of a tool, such as a scissors-type lifting table, said protective bellows (1) comprising at least three sheet-like bellows blanks (2), each of which has two opposite saw-tooth edges (3), a first set of fold lines (5) extending between opposite crests (6) of the saw-tooth edges (3), and a second set of fold lines (7) extending between opposite troughs (8) of the saw-tooth edges (3), characterised in that the first set of fold lines (5) is provided on one side of the blank (2) and the second set of fold lines (7) is provided on the other side of the blank (2), that the blanks (2) are interconnected along their saw-tooth edges so as to form a tubular unit, that the blanks are made of a synthetic material, and that the fold lines (5, 7) are provided by high-frequency welding.

2. The protective bellows of claim 1, characterised in that an end portion of each blank located between the last fold line and the terminal edge at one end of the blank is twice as wide as a portion located immediately inwardly thereof between two adjacent fold lines, that the end portion is folded and connected to said portion so as to form an upright flap, and that the flaps of the blanks together form a circumferential flange for connecting the bellows to the tool.

3. The protective bellows of any one of the preceding claims, characterised in that the terminal edge at said other end of each blank is folded back and connected to the blank so as to form a channel adapted to receive a fastening element for connecting the bellows to the tool or a base structure.

4. The protective bellows of any one of the preceding claims, characterised in that the synthetic material is PVC.

5. A method for making a protective bellows (1) for movable parts of a tool, such as a scissors-type lifting table, wherein two opposite edges (3) of each of at least three sheet-like bellows blanks (2) are given a saw-tooth shape, a first set of fold lines (5) being provided between opposite crests (6) of the saw-tooth edges (3), and a second set of fold lines (7) being provided between opposite troughs (8) of the saw-tooth edges (3), c h a r a c t e r i s e d by providing the first set of fold lines (7) on one side of the blank (2); providing the second set of fold lines (7) on the other side of the blank (2); interconnecting the blanks (2) along their saw-tooth edges (3) so as to form a tubular unit; and heating and deforming the material by high-frequency welding, whereby to form the fold lines (5, 7).

FIG.3

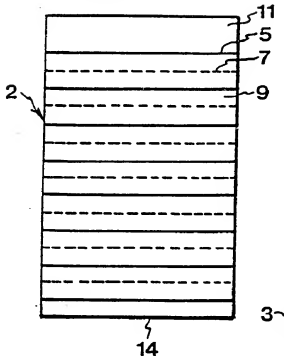


FIG.4

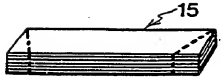


FIG.5

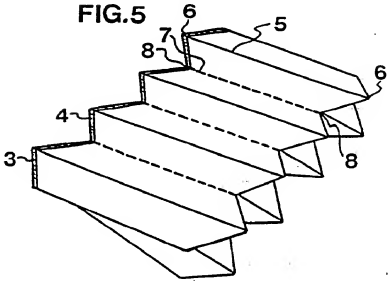


FIG.1

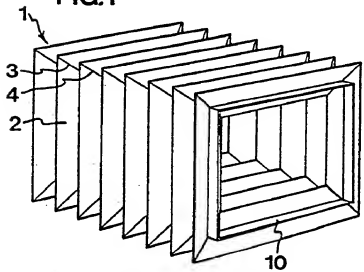
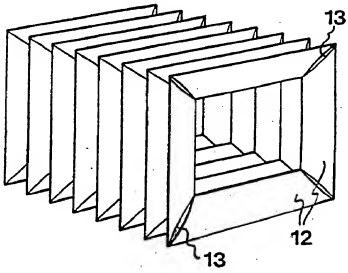


FIG.2



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00706

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: F 16 J 3/04, F 16 P 3/02, B 23 Q 11/08

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	F 16 J; F 16 P; B 23 Q; G 03 B; G 12 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with Indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	DE, C, 485172 (C. NEITHOLD A.G.) 28 October 1929, see page 2, line 33 - line 46 --	1
A	DE, B, 1251650 (D.C. TURNER) 5 October 1965, see figure 2 --	1
A	DE, A1, 3027083 (MÖLLER WERKE GMBH) 11 February 1982, see the whole document --	1
A	DE, A1, 3532702 (ARNO ARNOLD GMBH & CO.) 26 March 1987, see column 2, line 1 - line 5; column 2, line 25 --	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15th January 1993	20 -01- 1993
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Herman Phalén

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, C, 498330 (A. NAGEL) 21 May 1930, see the whole document --	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00706

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 02/12/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C- 485172	29-10-28	NONE	
DE-B- 1251650	65-10-05	NONE	
DE-A1- 3027083	82-02-11	NONE	
DE-A1- 3532702	87-03-26	NONE	
DE-C- 498330	30-05-21	NONE	